PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-215718

(43)Date of publication of application : 10.08.2001

---

(51)Int.Cl. G03F 7/20
G03F 7/22
G03F 9/00
H01L 21/027

---

(21)Application number : 2000-316451

(22)Date of filing : 17.10.2000

(71)Applicant : NIKON CORP

(72)Inventor : YANAGIHARA MASAMITSU
KATSUME TOSHIHIRO

---

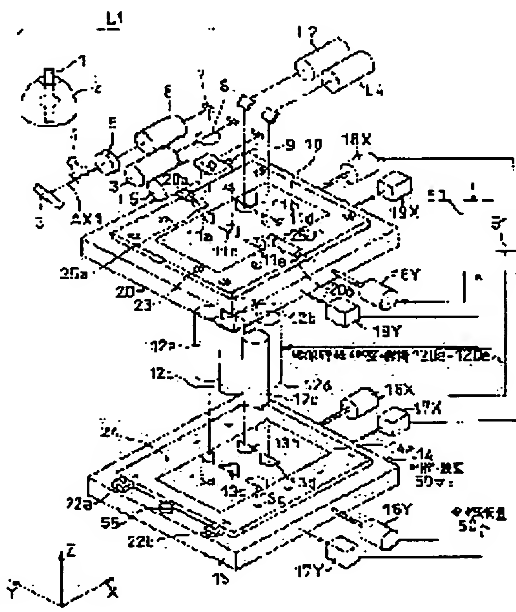
(30)Priority

Priority number : 11336472 Priority date : 26.11.1999 Priority country : JP

---

(54) EXPOSURE SYSTEM AND EXPOSURE METHOD

(57)Abstract:



PROBLEM TO BE SOLVED: To provide an exposure system and exposure method capable of minimizing the residual components of errors of linear correction and realizing higher fineness during the progression of the upsizing of a photosensitive substrate and device.

SOLUTION: Projection optical systems 12a to 12e of the scanning exposure system which subject a mask 10 and the photosensitive substrate 14 to scanning exposure in synchronization have image formation characteristic regulating mechanisms 120 for regulating the positions in the scanning direction of the projected images to be projected to the substrate. The nonlinear components of the exposure errors in the scanning direction are determined and are previously registered as correction values. The pattern exposure is executed while the image formation characteristic regulating mechanisms 120 in the scanning direction of the projection optical systems are continuously controlled in accordance with the correction values.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The aligner which carries out the synchronous scan of a mask and a substrate with a pattern in a predetermined scanning direction, and is characterized by having the scanning direction adjustment device which adjusts the location of said scanning direction of the projection image which said projection optics projects on said substrate in the aligner which exposes the pattern of said mask to said substrate through projection optics.
[Claim 2] It is the aligner characterized by having the configuration which combined 2 sets of Dyson mold optical system equipped with the mechanical component to which said projection optics drives a reflecting prism and said reflecting prism in an aligner according to claim 1, a lens, and a concave mirror, and having scale-factor adjustment optical system on the optical path between said reflecting prism of one Dyson mold optical system, and said lens.
[Claim 3] It is the aligner which said projection optics has two or more projection optics modules arranged along the direction which intersects said scanning direction in an aligner according to claim 1, and is characterized by said scanning direction adjustment device adjusting the location of the projection image of each of said scanning direction of two or more of said projection optics modules.

[Claim 4] It is the aligner characterized by for said projection optics having two or more projection optics modules in an aligner according to claim 1, overlapping in a part of projection image of this projection optics module, and exposing said pattern to said substrate.
[Claim 5] It is the aligner characterized by said scanning direction adjustment device adjusting the location of said projection image according to change of the configuration of said substrate in the aligner of claim 1-4 given in any 1 term.
[Claim 6] The aligner characterized by having at least one of the scale-factor adjustment device in which scale-factor adjustment of said projection optics is performed, and the image rolling mechanisms which rotate the projection image of said projection optics in an aligner given in any 1 term of claims 1-5.
[Claim 7] The exposure approach which carries out the synchronous scan of a mask and a substrate with a pattern in a predetermined scanning direction, and is characterized by including the step which adjusts the location of said scanning direction of the projection image which said projection optics projects on said substrate in the exposure approach which exposes the pattern of said mask to said substrate through projection optics.
[Claim 8] It is the exposure approach which said projection optics has two or more projection optics modules arranged along the direction which intersects said scanning direction in the exposure approach according to claim 7, and is characterized by adjustment of the location of said scanning direction adjusting the location of the projection image of each of said scanning direction of two or more of said projection optics modules.
[Claim 9] It is the exposure approach characterized by for said projection optics having two or more projection optics modules in the exposure approach according to claim 7, overlapping in a part of projection image of this projection optics module, and exposing said pattern to said substrate.
[Claim 10] It is the exposure approach characterized by performing adjustment of the location of said scanning direction according to change of the configuration of said substrate in the exposure approach according to claim 7 or 8.

[Claim 11] The exposure approach characterized by including at least one step of the step which performs scale-factor adjustment of said projection optics, and the step which rotates the projection image of said projection optics in the exposure approach of claim 7-10 given in any 1 term.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About the aligner and the exposure approach with two or more projection optics and illumination systems of a scanning mold, especially, justification between optical system is easy for this invention, and it relates to a suitable aligner to also expose the substrate which deformation produced in the process, and the exposure approach.
[0002]
[Description of the Prior Art] The display quality of a liquid crystal display panel improves remarkably in recent years, and moreover, since it is thin and lightweight, it is widely used instead of CRT as an image display device. Especially, with the direct viewing type liquid crystal panel of an active-matrix method, big screen-ization progressed and the glass substrate used for the manufacture is also enlarged.
[0003] As an aligner for exposing the component pattern of a display panel to such a large-sized glass substrate, the image of the subject-copy pattern formed in the photo mask or the reticle (henceforth a mask) is projected on a glass substrate (henceforth a sensitization substrate) through projection optics, and there is a scanning aligner of the type which scans a mask and a sensitization substrate to projection optics in that case.
[0004] The scanning aligner which performs exposure processing to a glass substrate as an example of the above-mentioned projection aligner is explained using drawing 22 and drawing 23 . The perspective view in which drawing 22 shows the configuration of the outline of the conventional scanning aligner, and drawing 23 are drawings showing the important section.
[0005] In drawing 22 and drawing 23 , the sensitization substrate 103 is held on the sensitization substrate stage 102 which is the bottom surface part of the carriage 101 with which the cross section was formed in the U shape, and a mask 105 is held in the upper mask stage 104 which counters the sensitization substrate stage 102. And when the pattern of some fields of the mask 105 held by the exposure light irradiated from the illumination-light study system 106 in the mask stage 104 is illuminated and the exposure light which passed the mask 105 passes the image formation optical system (projection optics) 107, the pattern of some fields of a mask 105 is imprinted by some fields on the sensitization substrate 103. And the whole surface of the pattern space on a mask 105 is imprinted on the sensitization substrate 103 by making the sensitization substrate stage 102 holding the mask stage 104 and the sensitization substrate 103 which hold a mask 105 to the image formation optical system 107 scan relatively.
[0006] Moreover, the image formation optical system 107 is replaced with single projection optics, two or more projection optics 107a-107d is allotted, and the flux of light injected from the illumination-light study system 106 illuminates two or more small fields on a mask 105, respectively. The imprint image of two or more of these small fields is projected on the sensitization substrate 103 at coincidence through two or more projection optics [107a-107d] each.
[0007] Drawing 24 is drawing showing the exposure image of the scan by the above-mentioned scanning aligner, and a step. The image formation optical system (projection optics) 107 has the exposure field shown in drawing 24 , it carries out a scan (SCAN1, SCAN2) in the direction A (scanning direction) twice to the sensitization substrate 103, it carries out a step in the direction B after SCAN2 termination, carries out a scan (SCAN3, SCAN4) in the direction C (scanning

direction) twice further, and finishes the imprint of an entire mask pattern.
[0008] Moreover, the maintenance device of the sensitization substrate 103 has the X-Y stage of the long stroke which makes a scan and a step possible, and has X of the long stroke for scanning, and the stage of the small stroke for amendment of the direction of Y and hand of cut which enable relative-position amendment with the sensitization substrate 103 in the maintenance device of a mask 105.
[0009] In the above exposure actuation, the projection image of the pattern formed in the mask 105 and the patterned layer already formed on the sensitization substrate 103 pile up correctly. Then, alignment of a mask 105 and the sensitization substrate 103 is performed.
[0010] In order to perform this alignment, the alignment mark formed on the mask 105 and the alignment mark formed on the sensitization substrate 103 are observed under the alignment microscope 108, these location gaps are detected, and amendment of the physical relationship of a mask 105 and the sensitization substrate 103 is performed. Two or more alignment marks are formed in the direction both ends of Y of the sensitization substrate 103 and a mask 105 along the direction of X, and observation under the alignment microscope 108 is performed to those 1 or plurality. And based on the detection result of these alignment microscope 108, the relative position of the sensitization substrate 103 to a mask 105, relative size, etc. are grasped, based on this, the location of a mask 105 is adjusted or the scale factor of the image formation optical system 107 is amended.
[0011] Drawing 25 is drawing for explaining alignment (alignment) actuation with the mask 105 and the sensitization substrate 103 which are performed with the above-mentioned scanning aligner. For example, by the detection result under the alignment microscope 108, as shown in drawing 25 (a) When it becomes clear that it is in the condition that the sensitization substrate 103 and the mask 105 are shifted in parallel with the direction of X and the direction of Y relatively (it has shifted) The parallel displacement of the specified quantity mask 105 is carried out by driving the actuator made to move the mask table holding a mask 105 in the direction of X, and two actuators moved in the direction of Y (shift amendment).
[0012] Moreover, as shown in drawing 25 (b), when the sensitization substrate 103 and the mask 105 have produced the rotation gap in the circumference of the Z-axis, specified quantity rotation of the mask 105 is carried out by changing the amount of drives of two actuators moved in the direction of Y (rotation amendment). moreover, as shown in drawing 25 (c), when the relative magnitude of a mask 105 and the sensitization substrate 103 differs While amending the scale factor of the image formation optical system 107 about the direction of Y, about the direction of X As the actuator moved in the direction of X is driven, the midst in which carriage 101 is carrying out scan migration is made to move a mask 105 in the direction of X and a specified quantity change of the relative scan speed of a mask 105 and the sensitization substrate 103 is made, the scale factor of the direction of X is amended (scaling amendment).
[0013] When 4 ppm of sensitization substrates 103 are extended in the direction of X, specifically, a mask 105 should just drive the actuator moved in the direction of X so that it may be made to move to hard flow by 4 ppm with a scanning direction according to the scan of carriage 21. In addition, the alignment mark of a mask 105 is beforehand created at the time of mask making, and, generally the alignment mark of the sensitization substrate 103 is created at the time of first-time exposure processing.
[0014] As mentioned above, it is possible for the above-mentioned scanning aligner to carry the alignment optical system which performs alignment for heavy exposure, to perform alignment measurement of two or more points for every scan, to compute the shift of the scanning direction, the shift of the non-scanning direction, a scale factor, rotation, and the linearity component of perpendicularity from each result, and to season scanning exposure. About the scale factor of each shift, rotation, perpendicularity, and the scanning direction, it amends by shifting the relative position of a mask and a sensitization substrate, and amends about the scale factor of the non-scanning direction by amending the scale-factor amendment device prepared in each image formation optical system, and the shift device of the non-scanning direction.
[0015]
[Problem(s) to be Solved by the Invention] In the aligner using two or more above-mentioned conventional projection optics After completing each projection optics (henceforth a module) of two

or more projection optics which performs screen composition so that it may become the predetermined engine performance, in order to combine in sufficient location precision for screen composition The dimensional accuracy of each module needed to be managed severely, and needed to be combined, and readjustment of the location after combination had the problem that it was necessary to redo the combination of each module from the beginning.

[0016] Moreover, it is possible that the device engine performance are satisfied only with the linearity amendment mentioned above of the engine performance is not obtained in scan exposure of a mask pattern with enlargement of a liquid crystal device in recent years, and highly-minute-izing. That is, in the phase which forms a layer in device creation, although generating of deformation by the heat of a substrate etc. is possible at processes other than exposure, while the absolute value of the residual component of the error of linearity amendment becomes large, in highly-minute-izing, it is necessary to make a residual component with error into the minimum by enlargement of a substrate, and enlargement of a device.

[0017] For example, the sensitization substrate by which is generally conveyed by the projection aligner and exposure processing is carried out passes heat-treatment of multiple times in a process, and exposure of a subject-copy pattern is repeated over many layers. A sensitization substrate may carry out telescopic motion etc. and that configuration may mainly change with the heat-treatment in this process. For example, by passing through various processes, it may bend rounded in the direction of Y, or as shown in drawing 26 (a), the sensitization substrate each **** of whose was a straight line-like mostly in the rectangle for the flat-surface configuration may deform into a parallelogram configuration, as shown in drawing 26 (c), as shown in drawing 26 (b).

[0018] However, if it is going to expose the sensitization substrate which has produced deformation as shown in these drawing 26 (b) and (c), since the deformation of the direction of Y will change serially with scan migration in the direction of X in exposure actuation, in shift amendment, conventional rotation amendment, and conventional scaling amendment, it has the problem that alignment cannot fully be amended. The pattern exposed without performing exact alignment will produce the superposition error which cannot be disregarded between the patterns of a substrate, and will produce the problem that the properties of the component of a large number formed on the sensitization substrate will differ for every field of a sensitization substrate as a result.

[0019] It was made in view of the above-mentioned trouble, the adjustment at the time of assembly is easy for this invention, and also when the need for readjustment arises during equipment employment, it aims at offering the aligner which makes readjustment possible for a short time. Moreover, in scan exposure of a mask pattern, this invention can stop the residual component of the error of linearity amendment to the minimum, and aims at offering the aligner and the exposure approach highly minute-ization is realizable for the inside to which enlargement of a sensitization substrate and a device goes.

[0020]

[Means for Solving the Problem] We decided to give a means to amend the position error detected by the aligner by this invention with the location detection means of the projection image by two or more projection optics for solution of the above-mentioned trouble.

[0021] Even when dimensional accuracy of each module did not need to be managed severely and the readjustment after module combination is needed by having the location detection means of a projection optics image, and a means to amend the detected position error, it becomes unnecessary thus, to redo the combination of each module from the beginning.

[0022] Moreover, in this invention, the synchronous scan of a mask and a substrate with a pattern is carried out in a predetermined scanning direction, and projection optics is characterized by having the scanning direction adjustment device which adjusts the location of said scanning direction of the projection image projected on a substrate in the aligner which exposes the pattern of a mask to a substrate through projection optics.

[0023] Projection optics shall have the configuration which combined 2 sets of Dyson mold optical system equipped with a reflecting prism, the mechanical component which drives a reflecting prism, a lens, and a concave mirror, and shall be equipped with scale-factor adjustment optical system on the optical path between the reflecting prism of one Dyson mold optical system, and a lens.

[0024] Moreover, projection optics has two or more projection optics modules arranged along the

direction which intersects a scanning direction, and a scanning direction adjustment device may adjust the location of the projection image of each of said scanning direction of two or more projection optics modules. Moreover, projection optics has two or more projection optics modules, overlaps in a part of projection image of this projection optics module, and may expose a pattern to a substrate.
[0025] A scanning direction adjustment device may adjust the location of a projection image according to change of the configuration of a substrate. Moreover, you may have at least one of the scale-factor adjustment device in which scale-factor adjustment of projection optics is performed, and the image rolling mechanisms which rotate the projection image of projection optics.
[0026] The exposure approach of this invention carries out the synchronous scan of a mask and a substrate with a pattern in a predetermined scanning direction, and it is characterized by projection optics containing the step which adjusts the location of said scanning direction of the projection image projected on a substrate in the exposure approach which exposes the pattern of said mask to said substrate through projection optics.
[0027] At this time, projection optics has two or more projection optics modules arranged along the direction which intersects said scanning direction, and adjustment of the location of a scanning direction may adjust the location of the projection image of each of said scanning direction of two or more projection optics modules.
[0028] Moreover, projection optics has two or more projection optics modules, overlaps in a part of projection image of this projection optics module, and may expose a pattern to a substrate. Moreover, adjustment of the location of a scanning direction may be performed according to change of the configuration of a substrate. Moreover, at least one step of the step which performs scale-factor adjustment of projection optics, and the step which rotates the projection image of projection optics may be included.
[0029] Justification of the projection image under exposure by projection optics is performed corresponding to deformation of the substrate generated in down stream processing. The deformation of a substrate can be calculated by measuring two or more alignment marks prepared in the position of a substrate. Moreover, the deformation in the whole substrate surface is correctly measurable by measuring the location of the pattern regularly arranged on a substrate. In this case, deformation of a substrate can be grasped almost correctly by measuring the pattern location on the substrate recognized with pattern matching, and carrying out statistics processing of that measurement data. In this way, it becomes possible to adjust the relative location of a projection image and a substrate by rotating the image projected from projection optics to compensate for deformation of the measured substrate, making it shift, or changing a scale factor.
[0030]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing. Drawing 1 is drawing showing the rough configuration of an example of the scanning aligner by this invention. After being reflected in the ellipse mirror 2, incidence of the flux of light injected from the light source 1 of an extra-high pressure mercury lamp etc. is carried out to a dichroic mirror 3. This dichroic mirror 3 reflects the flux of light of wavelength required for exposure, and penetrates the flux of light of other wavelength. The flux of light reflected with the dichroic mirror 3 is alternatively restricted in the exposure by the side of projection optics by the shutter 4 arranged possible [an attitude] to an optical axis AX1. By opening a shutter 4 wide, incidence of the flux of light is carried out to the wavelength selection filter 5, and it turns into the flux of light of the wavelength (at least one band among [Usually] g, h, and i line) suitable for projection optics 12a imprinting. Moreover, since the intensity distribution of this flux of light become the shape of Gaussian distribution which will fall if it is the highest near the optical axis and it becomes on the outskirts, they need to make reinforcement homogeneity within projection field 13a of projection optics 12a at least. For this reason, the reinforcement of the flux of light is equalized by the fly eye lens 6 and the condenser lens 8. In addition, a mirror 7 is a bending mirror on an array.
[0031] The flux of light which had reinforcement equalized is irradiated on the pattern side of a mask 10 through a field diaphragm 9. This field diaphragm 9 has opening which restricts projection field 13a on the sensitization substrate 14. A lens system is established between a field diaphragm 9

and a mask 10, and you may make it a field diaphragm 9, the pattern side of a mask 10, and the plane of projection of the sensitization substrate 14 become conjugate mutually.
[0032] The configuration from the light source 1 to a field diaphragm 9 is made into the illumination-light study system L1 to projection optics 12a, in this example, the illumination-light study system L1 and the illumination-light study systems L2-L5 which have the same configuration are formed, and the flux of light from each illumination-light study systems L2-L5 is supplied to each of projection optics 12b-12e. The flux of light injected from each of two or more illumination-light study systems L1-L5 illuminates the subregions (lighting field) 11a-11e where it differs on a mask 10, respectively. Here, the direction of an optical axis of projection optics 12a-12e is made into a Z direction, the scanning direction of a mask 10 and the sensitization substrate 14 is made into the direction of X in a direction perpendicular to a Z direction, and a direction perpendicular to a Z direction and the direction of X is made into the direction of Y.
[0033] Subregions 11a-11e are two or more field diaphragms which have the frontage of the trapezoidal shape which specifies the exposure field of the exposure light to a mask 10, and it has alternately the subregions 11a, 11c, and 11e of the 2nd train by turns to the subregions 11b and 11d of the 1st train. In a criteria location, as the direction edge of subregions [the subregions 11b and 11d of the 1st train and] 11a, 11c, and 11e of the 2nd train of Y of both field diaphragms suits in a specified quantity pile seen from the direction of X, they are located. The edge field which suits in the direction of X in Subregions 11a-11e in a specified quantity pile will be hereafter called a splice field. The pattern image of the mask which passes through this splice field in the case of scan exposure is exposed on the both sides of the subregions 11b and 11d of the 1st train, and the subregions 11a, 11c, and 11e of the 2nd train, and the optimal addition light exposure is obtained. Moreover, the distance of the center position of the direction of X of a subregions [of the 1st train / 11b and 11d] field diaphragm and the center position of the direction of field-diaphragm X of the subregions 11a, 11c, and 11e of the 2nd train is set as d (refer to drawing 5).
[0034] Moreover, this scanning aligner is equipped with five projection optics 12a-12e which was made to correspond to each subregions 11a-11e, and was arranged alternately in order to imprint the pattern of the mask 10 on the exposure field specified by the subregions 11a-11e which are the lighting field-diaphragm sections to the sensitization substrate 14. These projection optics 12a-12e is put in order by two trains in the direction of Y, and each projection optics is assigned to the exposure field on the mask 10 specified by each subregions 11a-11e, respectively.
[0035] Moreover, the projection optics 12b, 12d (henceforth the 1st projection train), 12a, 12c, and 12e (henceforth the 2nd projection train) of each train is equipped with the image formation property adjustment device 120 (scanning direction adjustment device). It explains taking the case of the case where the projection optics which combined 2 sets of Dyson mold optical system as projection optics 12a-12d is adopted hereafter.
[0036] Drawing 2 , drawing 3 , and drawing 4 are drawings showing the amendment device of the lens module with which projection optics 12a-12e was equipped, and are expressed typically [one] of the projection optics 12a-12e. Here explains projection optics 12a-12e on behalf of the image formation property adjustment device of projection optics 12a in order to take the same configuration.
[0037] Projection optics 12a has the configuration which combined 2 sets of Dyson mold optical system up and down, and becomes the 1st partial optical system 31-33 and a field diaphragm 34 from the 2nd partial optical system 35-37. The 1st partial optical system has the lens 32 and concave mirror 33 which have the rectangular prism 31 with two reflectors which faced the mask 10 and have been arranged on the **45-degree inclination, and an optical axis in alignment with the field inboard of a mask 10. The 2nd partial optical system has the lens 36 and concave mirror 37 which have the rectangular prism 35 with two reflectors which faced the mask 10 and have been arranged on the **45-degree inclination, and an optical axis in alignment with the field inboard of a mask 10.
[0038] The shifter section for projection optics 12a to shift further the pattern image of the mask 10 imprinted by the sensitization substrate 14 as an image formation property adjustment device according to migration of the direction of X of a mask 10, and the direction of Y (shift device), It has the rotation amendment section (rotation amendment device) which rotates the pattern image of the mask 10 imprinted by the sensitization substrate 14, and the scale-factor controller (scale-factor

amendment device) which adjusts the scale factor of the pattern image of the mask 10 imprinted by the sensitization substrate 14. The shifter section of each projection optics 12a-12e, the rotation amendment section, and a scale-factor controller are controlled by the control unit 50 according to an individual.
[0039] The shifter section consists of parallel monotonous glass 41 and 42 arranged directly under a mask, and shifts the pattern image of the mask 10 imprinted by the sensitization substrate 14 in the direction of X, or the direction of Y by rotating the parallel monotonous glass 41 for X shift, and the parallel monotonous glass 42 for Y shift by the driving means of a motor etc.
[0040] In the rotation amendment section, as shown in drawing 3 , rotation amendment is performed by rotating the rectangular prism 31 currently fixed to the prism base 43 through piezo-electric elements 44a and 44b around an optical axis. The arrow head a of drawing 3 or its opposite direction is made to rotate a rectangular prism 31 driving one of the piezo-electric elements 44a and 44b, or by driving both piezo-electric elements 44a and 44b to hard flow. This rotates a projection image in the hand of cut and this direction of a rectangular prism 31.
[0041] Moreover, as shown in drawing 4 , whether only the same amount as coincidence lengthens both piezo-electric elements 44a and 44b, and when [if it contracts,] a rectangular prism 31 will move to the direction of an arrow head c, or its opposite direction, the optical path difference can arise, a focal location can change, and focal adjustment can be performed. In addition, although he is trying to arrange a piezo-electric element to two places by a diagram, you may make it support a rectangular prism 31 by three points using three piezo-electric elements.
[0042] A scale-factor controller is realizable by inserting the zoom optical system 45 which consisted of three optical lenses on one optical axis between a rectangular prism 31, a lens 32, and the rectangular prism 31 of the Dyson mold optical system and lens 32 that were located in a line with the concave mirror 33, for example, the optical axis of an input side. The projection scale factor of an image becomes controllable by controlling spacing of three lenses of the zoom optical system 45 by the actuators 46, such as a piezo-electric element. A projection scale factor can be made adjustable also by permuting with the gas which has a refractive index which is different from air in between the lenses of the zoom optical system 45 also besides controlling lens spacing of the zoom optical system 45. In addition, when the zoom optical system 45 which adjusts a scale factor is put into the optical path of one Dyson mold optical system, you may make it put the amendment optical system 47 which consists of a fixed lens group into the optical path of the Dyson mold optical system of another side so that the effect by the zoom optical system may be negated.
[0043] The primary image of the mask 10 formed of the 1st partial optical system (the Dyson mold optical system) 31-33 is an actual size image whose lateral magnification of the direction of Y the lateral magnification of the direction of X is forward, and is negative. The light from a primary image forms the secondary image of a mask 10 on the front face of the sensitization substrate 14 through the 2nd partial optical system 35-37. Therefore, the secondary image formed in the front face of the sensitization substrate 14 turns into an erect image (image forward in the lateral magnification of the direction of four directions) of the actual size of a mask 10. The field diaphragm 34 is arranged in the location of the primary image which the 1st partial optical system forms.
[0044] Moreover, initial adjustment of projection optics can be performed by controlling the shifter section of each projection optics 12a-12e, the rotation amendment section, and a scale-factor controller. For example, by receiving the reference mark prepared in the mask 10 with the image sensor 55 in which it was prepared on the substrate stage 15, the rotation of a projection image is calculated, and based on the value, the rotation of a rectangular prism is controlled by the each projection optics [12a-12d] rotation amendment section so that an image rotation becomes below a predetermined value. About the shift of an image, the amount which carries out the monitor of the location of the mask pattern projected on the image sensor 55 formed in the substrate stage 15, and shifts it is determined by carrying out specified quantity rotation of the parallel monotonous glass of the shifter section. It is possible by projecting the pattern of a mask on the image sensor 55 of the substrate stage 15, and carrying out the monitor of the location of the image about a scale factor as well as rotation of image amendment, to adjust a scale factor correctly.
[0045] Deformation of a substrate differs in the location and exposure termination location of exposure initiation, and while exposing an image formation property adjustment device, it is driven

so that it may correspond to deformation of the substrate currently measured beforehand, so that it may mention later. At this time, it is possible to amend suitably by giving a table beforehand about the amounts of drives, such as a piezo-electric element which changes an image formation condition, and a motor, and an optical operation.

[0046] Moreover, two or more imprint images P1-P5 on the sensitization substrate 14 are orthopedically operated by trapezoidal shape, respectively, as shown in drawing 5 . The surface of each trapezoidal shape is turned to the side which the 1st imprint **** which consists of imprint images P2 and P4, and the 2nd imprint **** which consists of imprint images P1, P3, and P5 counter. Moreover, a core is mutually separated only for the distance d between trains, and the distance Ly between images in the direction of X, and the direction of Y, respectively, and the adjacent imprint images P1-P5 (for example, P1, and P2, P2 and P3) are arranged so that the edge of trapezoidal shape may overlap in the direction of Y.

[0047] The optical axis of two or more projection optics 12a-12e is also mutually separated only for the distance d between trains, and the distance Ly between images in the direction of X, and the direction of Y corresponding to arrangement of the core of two or more imprint images P1-P5, respectively. Two or more illumination-light study systems L1-L5 are allotted so that the core of two or more subregions 11a-11e on a mask 10 may serve as the same arrangement as two or more imprint images P1-P5.

[0048] Two or more flux of lights which penetrated the mask 10 carry out image formation of the pattern image of the lighting fields 11a-11e of a mask 10 to the projection fields 13a-13e to which it differs on the sensitization substrate 14 through the projection optics 12a-12e corresponding to each illumination-light study systems L1-L5. Projection optics 12a-12e is all erection actual size real image formation (erect normal image) optical system.

[0049] The sensitization substrate 14 is laid in the substrate stage 15, and the substrate stage 15 has direction driving gear of X 16X which had a long stroke in the scanning direction (the direction of X) so that it may perform scan exposure of a single dimension. Furthermore, about a scanning direction, it has a high resolution and highly precise direction location measuring device of X (for example, laser interferometer) 17X. Moreover, a mask 10 is supported by the mask stage 20 and this mask stage 20 as well as the substrate stage 15 has direction driving gear of X 18X which had a long stroke in the scanning direction (the direction of X), and direction location measuring device of X 19X which detects the location of the scanning direction of a mask stage 20.

[0050] Furthermore, the substrate stage 15 and a mask stage 20 have the function which moves in the direction of Y which intersects perpendicularly with the direction of X which is a scanning direction mostly. That is, direction driving gear of Y 16Y and direction location measuring device of Y 17Y which drive the substrate stage 15 in the direction of Y are prepared in the substrate stage 15. Similarly, direction driving gear of Y 18Y which drives a mask stage 20 in the direction of Y, and direction location measuring device of Y 19Y which detects the location of the direction of Y of a mask stage 20 are prepared in the mask stage 20. The image sensor 55 is installed in the substrate stage 15, and the edge of the mask pattern of the trapezoidal shape projected on the sensitization substrate 14 is detected. Moreover, on the substrate stage 15, the Z stage which is not illustrated for moving a sensitization substrate up and down is installed. The relation of a best focus location can be known by changing and exposing the height of a Z stage.

[0051] In addition, the sensitization substrate 14 and a mask 10 can be fixed on the character type scan frame of KO, and it can also constitute so that it may drive to a scanning direction (the direction of X) by making the sensitization substrate 14 and a mask 10 into one. In that case, if it has the driving gear which drives the scan frame which laid the sensitization substrate 14 and the mask 10 in the direction of X, it is not necessary to have direction driving gear of X 16X which drives the substrate stage 15 in the direction of X, and direction driving gear of X 18X which drives a mask stage 20 in the direction of X according to an individual.

[0052] Drawing 6 is the plan of the sensitization substrate 14 held on the substrate stage 15. The projection fields 13a-13e on the sensitization substrate 14 are arranged as the edges of a ****** field show with a broken line so that [as shown in drawing 6 , so that ****** fields (for example, 13a, and 13b, 13b and 13c) may carry out specified quantity displacement in the direction of X of drawing in the direction of Y, and] it may overlap in the direction of Y. Therefore, while two or

more above-mentioned projection optics 12a-12e also carries out specified quantity displacement in the direction of X corresponding to arrangement of each projection fields 13a-13e, it overlaps in the direction of Y and is arranged. Although the configuration of the projection fields 13a-13e is a trapezoid by a diagram, they may be configurations, such as a hexagon, and a rhombus, a parallelogram. Moreover, two or more illumination-light study systems L1-L5 are arranged so that the lighting fields 11a-11e on a mask 10 may serve as the same arrangement as the above-mentioned projection fields 13a-13e. The alignment marks (substrate mark) 24a-24j are formed in the outside of exposure field 14a at the sensitization substrate 14.

[0053] Drawing 7 is the plan of a mask 10 and pattern space 10a in which the pattern which should be imprinted to the sensitization substrate 14 was formed is formed. The alignment marks (mask mark) 23a-23j corresponding to the substrate marks 24a-24j of the sensitization substrate 14 are formed in the outside of pattern space 10a at the mask 10. In the case of this example, the direction dimension of Y of pattern space 10a formed in the mask 10 is larger than the direction dimension of Y of the lighting fields 11a-11e so that clearly from drawing.

[0054] Above a mask 10, as shown in drawing 1 and drawing 7 , the alignment systems 20a and 20b are arranged, and while detecting the mask marks 23a-23j prepared in the mask 10 by these alignment systems 20a and 20b, the substrate marks 24a-24j formed on the sensitization substrate 14 through projection optics 12a and 12e are detected. That is, the substrate marks 24a-24j on the sensitization substrate 14 are irradiated through the optical system 12a and 12e of the both ends of the projection optics 12a-12e which arranged two or more illumination light injected from the alignment systems 20a and 20b while irradiating the mask marks 23a-23j formed on the mask 10 through reflecting mirrors 25a and 25b.

[0055] Incidence of the reflected light from the mask marks 23a-23j by which the reflected light from the substrate marks 24a-24j formed on the sensitization substrate 14 was formed on the mask 10 through projection optics 12a and 12e and reflecting mirrors 25a and 25b is carried out to the alignment systems 20a and 20b through reflecting mirrors 25a and 25b, respectively. The alignment systems 20a and 20b detect the location of each alignment mark based on the reflected light from a mask 10 and the sensitization substrate 14.

[0056] Drawing 8 is the explanatory view showing the image which picturized the mask mark 23, when the alignment systems 20a and 20b are the things of the type which is equipped with a CCD camera as a detector and asks for the location of a mark by the image processing. 27 expresses the index mark for which the observation visual field of an alignment system was prepared in 28 in alignment system 20a and 20b. After carrying out predetermined distance migration of a mask stage 20 or the substrate stage 15 in the direction of X, it becomes possible by detecting the substrate marks 22a and 22b on the substrate stage 15, and the mask marks 23a-23j on a mask 10 to coincidence by the alignment systems 20a and 20b to match clearly the position coordinate of the substrate stage 15, and the position coordinate of a mask 10. If required, the location of a mask 10 will be controlled by making a mask stage 20 move slightly by direction driving gear of X 19X, and direction driving gear of Y 18Y.

[0057] Drawing 9 is drawing showing the image which picturized the mask mark 23 and the substrate mark 24 to coincidence by the alignment systems 20a and 20b. The alignment detection systems 20a and 20b can carry out a calibration to the datum reference of the substrate stage 15 by managing the location of the index mark 28 to the substrate mark 22 prepared on the substrate stage 15. Moreover, the relative position of the sensitization substrate 14 and a mask 10 is detectable by detecting the substrate marks 24a-24j on the sensitization substrate 14, and the mask marks 23a-23j on a mask 10 to coincidence by the alignment systems 20a and 20b, moving in the direction of X on a mask stage 20 and the substrate stage 15.

[0058] It returns to drawing 1 , and a control unit 50 outputs the control signal for controlling the image formation property adjustment devices 120a-120e inside each projection optics 12a-12e while controlling the whole scanning aligner and inputting the measurement result of the location measuring devices 17X, 17Y, 19X, and 19Y, and the alignment output of the alignment systems 20a and 20b.

[0059] A control unit 50 is constituted by the microcomputer etc., and it asks for a nonlinear component with error by detection of an alignment mark etc. beforehand, and the operation which

amends the shift device and the scale-factor amendment device of the non-scanning direction of image-formation optical system performs so that storage 51 may have and mention later, and the control which outputs a control signal to each image-formation property adjustment devices 120a-120e, and amends the nonlinear shift component of the non-scanning direction and a scale-factor component carries out.

[0060] Namely, based on the detection result outputted from the alignment systems 20a and 20b, a control unit 50 performs the same shift amendment as usual, and rotation amendment, further, it grasps the configuration of the sensitization substrate 14, calculates the correction value which amends change of the configuration of the sensitization substrate 14 over a scanning direction, and registers it into storage 51. Moreover, a control unit 50 controls the each projection optics [12a-12d] image formation property adjustment device 120 according to exposure working and the above-mentioned correction value.

[0061] Storage 51 consists of ROM, RAM, and an EEPROM (electrically erasable programmable ROM) that is rewritable nonvolatile memory electrically, and memorizes the control data for the program of a control device 50, and scan exposure, the data based on a nonlinear component with error, etc. further.

[0062] Hereafter, actuation of the scanning aligner constituted as mentioned above is explained. First, the fundamental view of this invention is described. The sensitization substrate 14 by which is conveyed by this scanning aligner and exposure processing is carried out passes heat-treatment of multiple times in a process, and exposure of a subject-copy pattern is repeated over many layers. The sensitization substrate 14 may carry out telescopic motion etc., and that configuration may mainly change with the heat-treatment in this process.

[0063] Drawing 10 is drawing showing the modification of the sensitization substrate 14. Among drawing, the rectangle part shown with a broken line expresses an ideal sensitization substrate without deformation, and this drawing continuous-line part expresses the sensitization substrate which deformed in the shape of a curve by passing through various processes. Besides the example of drawing 10 , there are various modifications, such as a slack type, a spool mold, and a shuttle-race-back mold. Since the deformation of the direction of Y which intersects perpendicularly with the direction of X (scanning direction) and the direction of X in exposure actuation changed serially when it was going to expose the sensitization substrate which has produced such deformation, in mere shift amendment, rotation amendment, and scaling amendment, alignment was not fully able to be amended.

[0064] In this invention, paying attention to deformation of the above-mentioned sensitization substrate being nonlinear, in quest of the nonlinear component of the exposure error of a scanning direction, it registers beforehand as correction value, and it is made to perform pattern exposure, controlling continuously the image shift device of the scanning direction of projection optics based on this correction value.

[0065] For this reason, when it asks for a nonlinear component with error by detection of an alignment mark etc. beforehand and a control unit 50 controls the shifter section 42 (shift device) and the scale-factor controller 45 (scale-factor amendment device) of the non-scanning direction of projection optics (image formation optical system) 12a-12e, the nonlinear shift component of the non-scanning direction and a scale-factor component are amended. Moreover, in order to compute a nonlinear component, the substrate mark (mark for heavy measurement) 24 which measures two or more superposition precision as shown in drawing 11 is arranged.

[0066] The configuration of forming the vernier (vernier) which replaces with the above-mentioned substrate mark 24, and measures two or more superposition precision here on the sensitization substrate 14 may be used. A vernier can combine the subgraduation which subdivides between the steps of the main graduation further, and can know the deformation of the sensitization substrate 14 from the coincidence part of both graduations. Furthermore, the approach of carrying out the image processing of direct reading and the read result for the exposure pattern (for example, electrode section of the transistor which drives a light emitting device) produced on the sensitization substrate 14, and calculating the deformation of the sensitization substrate 14 may be used. If such an approach is taken, it can respond also to the example of nonlinear components, such as configurations other than the example shown in drawing 10 , for example, a slack type, a spool mold,

and a shuttle-race-back mold.
[0067] next, the above -- an example of a sequence which registers the correction value of an exposure error according to a fundamental view is explained. Drawing 12 is a flow chart which shows the processing which registers the nonlinear component of the exposure error of a scanning direction, and before this flow performs the usual exposure processing, it is performed by the control unit 50. S shows each step of a flow among drawing.
[0068] In order that the liquid crystal panel of an active-matrix method may form the active component, it is necessary to pile up and expose two or more patterned layers by the production process. Therefore, since it is possible that the nonlinear components of an exposure error differ if production processes differ, it is desirable to carry out the exposure processing and correction value registration by this flow for every process of the sensitization substrate to expose.
[0069] First, a mask 10 is laid at step S10. The measurement pattern (here alignment mark) which can detect the nonlinear component of an exposure error with a sufficient precision is prepared in this mask 10 and the sensitization substrate 14 which is mentioned later and which should be exposed. In addition, the thing of the type which asks for the location of a mark of the exposure pattern which replaced with the mask 10 and the sensitization substrate 14 with which the measurement pattern only for the above was formed, and was produced on the sensitization substrate 14 by direct reading and the image processing may be used.
[0070] Subsequently, the new mask 10 is positioned to an aligner by the alignment systems 20a and 20b held by the attachment component holding projection optics 12a-12e at step S11. As drawing 9 explained, this positioning detects the mask marks 23a and 23j by the alignment systems 20a and 20b, and it is performed by adjusting by the driving means which does not illustrate the location of the mask laid on the mask stage 20 so that the location of the mask mark to the index mark 28 may serve as predetermined relation.
[0071] Subsequently, at step S12, loading of the sensitization substrate 14 for measurement which should be exposed on the substrate stage 15 with the substrate loader which is not illustrated is carried out, and the loaded sensitization substrate 14 is positioned to an aligner. The alignment systems 20a and 20b detect the substrate marks 24a and 24j as well as the alignment of the mask 10 in step S11, and specifically, it is carried out by controlling the driving means which was established on the substrate stage 15 and which is not illustrated so that the location of the substrate marks 24a and 24j to the index mark 28 may serve as predetermined relation.
[0072] At step S13, the outward trip scan of a mask 10 and the sensitization substrate 14 is synchronously carried out to projection optics 12a-12e by driving a mask stage 20 and the substrate stage 15 for example, in the direction of -X by direction driving gear of X 18X of a mask stage 20, and direction driving gear of X 16X of the substrate stage 15. One alignment system 20a detects the relative position of the mask marks 23a-23e and the substrate marks 24a-24e in that case. Alignment system 20b of another side detects the relative position of the mask marks 23f-23j and the substrate marks 24f-24j. In this way, the relative position with the detected mask marks 23a-23e, 23f-23j and the substrate marks 24a-24e, and 24f-24j is memorized by storage 51.
[0073] After alignment mark detection is completed, it progresses to step S14 and the measurement error of the sensitization substrate 14 corresponding to a mask 10 is computed for every predetermined pitch based on a measurement result. The nonlinear component of the exposure error of the sensitization substrate 14 makes this measure point an appropriately detectable location and an appropriately detectable pitch. In this case, you may enable it to measure in the pitch of arbitration according to a production process, the superposition precision of an exposure pattern, etc. Moreover, in the case of the approach of carrying out the image processing of direct reading and the read result for the exposure pattern produced by the sensitization substrate 14, and calculating the deformation of the sensitization substrate 14, a control unit 50 can perform immediately after measurement termination.
[0074] At step S15, it asks for the nonlinear component of the sensitization substrate 14 from a measurement error, and the amount of amendments amended so that this nonlinear component may be lost is calculated. For example, as shown in drawing 13 , when X-Y coordinate of a certain measure point on the sensitization substrate 14 is expressed with (-400, +300), if the measurement result has shifted from the X-Y coordinate (-400, +300), the value (for example, +0.5, -0.5) of X-Y

coordinate corresponding to the gap will be calculated as correction value.
[0075] Subsequently, at step S16, the above-mentioned amount of amendments is registered into storage 51 as a correction factor on an aligner, and this flow is ended. Thus, after the usual linearity amendment is performed, each error (the direction of X and the direction of Y) of said measure point is computed, and it registers with a recording device 51 as exposure data.
[0076] Namely, alignment of a mask 10 and the sensitization substrate 14 is performed at step S13. The direction of X of the mask 10 with which a pair of relative-position error of the mask marks 23a-23j memorized by storage 51 and the substrate marks 24a-24j corresponding to it serves as min, The movement magnitude of the direction of Y and a hand of cut is calculated with a least square method etc., and linearity amendment is performed by adjusting by the driving means which does not illustrate the location of the mask 10 on a mask stage 20 according to it. And even if it performs such linearity amendment, the nonlinear component of the sensitization substrate 14 which remains in addition is called for, and this nonlinear component is registered into storage 51 as a correction factor.
[0077] Next, exposure actuation of a scanning aligner is explained. About the amendment approach, it carries out by amending the shift device and scale-factor amendment device of the non-scanning direction of each image formation optical system. The target position of the shift device of the non-scanning direction of each image formation optical system for every scanning location and a scale-factor amendment device is computed from the registered data, and it drives during scanning exposure.
[0078] Drawing 14 and drawing 15 are drawings showing the sequence of amendment of a nonlinear component, and M1-M5 express the projection field of five projection optics (image formation optical system) 12a-12e in these drawings. Moreover, the sensitization substrate 14 expresses the sensitization substrate (refer to continuous-line section) which deformed in the shape of a curve like said drawing 10 to the ideal sensitization substrate (refer to broken-line section) without deformation.
[0079] Drawing 14 (a) is the phase of exposure initiation, and the exposure of M2 and M4 which is the 1st projection train among five projection fields M1-M5 starts. According to the correction value (correction factor) registered into storage 51, the shift device and scale-factor amendment device of the non-scanning direction of M2 and M4 are controlled in this phase. Specifically, projection optics [12b and 12d] the shifter section 42 (shift device) and the scale-factor controller 45 (scale-factor amendment device) of the image formation property adjustment device 120 of the 1st projection train are controlled by the control unit 50.
[0080] In drawing 14 (b), exposure of M1, M3, and M5 which are the 2nd projection train starts. In this phase, M2 and M4 are exposing the location of M1, M3 and M5, and the lens spacing part point of M2 and M4. Also in M1, M3, and M5, a control unit 50 controls the shifter section 42 (shift device) and the scale-factor controller 122 (scale-factor amendment device) like amendment of M2 and M4. Here, the shift device and scale-factor amendment device of the non-scanning direction of M1, M3, and M5 are driven to the target position in the location of drawing 14 (b), i.e., the location connected with amendment of M2 and M4 of drawing 14 (a). Thus, the correction value of M1, M3, and M5 is always driven to M2 and M4 for the purpose of the correction value of the coordinate which was overdue by lens spacing. By carrying out like this, the optimal nonlinear amendment becomes realizable in the equipment configuration which has the image formation optical system from which lens spacing differs.
[0081] Moreover, M2 and an about [M4] arrow head show that the correction value for performing control which reduces a scale factor in the location is registered, and the arrow head of the M2 and M4 interior shows that the correction value for performing shift control in the direction of an arrow head in the location is registered. In addition, the die length of an arrow head expresses the magnitude of the amount of amendments of correction value typically.
[0082] While M2 and M4 are deforming slightly in this location to the ideal sensitization substrate (refer to broken-line section) in which deformation does not have a sensitization substrate (refer to continuous-line section) and making M2 and M4 reduce at this time, the correction value which carries out shift amendment is registered in the direction of an arrow head. a control unit 50 -- this correction value -- following -- a shift device and a scale-factor amendment device -- controlling (it

controlling to reduce a scale factor in this case and to shift in the direction of a core of a sensitization substrate) -- M2 and M4 are amended in the direction of an arrow head in M2 and M4.
[0083] In drawing 14 (c), the case where M1, M3, and M5 drive even in the location of M2 and M4 of drawing 14 (b) is shown, and the correction value of M1, M3, and M5 turns into correction value corresponding to the correction value which amended M2 and M4 by drawing 14 (b). M1, M3, and M5 -- this correction value -- a control unit 50 -- a shift device and a scale-factor amendment device -- controlling (it controlling to reduce a scale factor in this case and to shift in the direction of a core of a sensitization substrate) -- about M1 and M5, it is amended among M1, M3, and M5 in the direction of an arrow head in M1 and M5. [therefore,]
[0084] At this time, M2 and M4 which are preceded with M1, M3, and M5 are approaching the center position of a sensitization substrate, and they have arrived at the deformation location still fewer than deformation of drawing 14 (b). In this location, correction value with a scale factor and a shift amount smaller than the correction value of drawing 14 (b) is registered. and the control unit 50 -- a shift device and a scale-factor amendment device -- controlling (it controlling to reduce a scale factor in this case and to shift in the direction of a core of a sensitization substrate) -- M2 and M4 are amended in the direction of an arrow head in M2 and M4.
[0085] In drawing 15 (d), the case where M1, M3, and M5 drive even in the location of M2 and M4 of drawing 14 (c) is shown, and the correction value of M1, M3, and M5 turns into correction value corresponding to the correction value which amended M2 and M4 by drawing 14 (c). Therefore, a control unit 50 controls a shift device and a scale-factor amendment device by this correction value, and M1, M3, and M5 are amended about M1 and M5 among M1, M3, and M5 in the direction of an arrow head in M1 and M5. At this time, M2 and M4 do not have deformation of a sensitization substrate in this location, and correction value is 0. Therefore, amendment of M2 and M4 is not performed.
[0086] In drawing 15 (e), since the case where M1, M3, and M5 drive even to the center position of the sensitization substrate which is the location of M2 and M4 of drawing 15 (d) is shown and there is no deformation of a sensitization substrate, amendment of M1, M3, and M5 is not performed. At this time, M2 and M4 are approaching the scan termination location of a sensitization substrate, in this location, the sensitization substrate (refer to continuous-line section) is deforming in the direction (the inside of the non-scanning direction bottom and drawing lower part) of -Y slightly to an ideal sensitization substrate (refer to broken-line section) without deformation, and the correction value which shifts M2 and M4 in this direction of -Y is registered into storage 51. And when a control unit 50 controls a shift device in the direction of -Y based on this correction value, M2 and M4 are amended in the direction of an arrow head of drawing.
[0087] In drawing 15 (f), the case where M1, M3, and M5 drive even in the location of M2 and M4 of drawing 15 (e) is shown, and the correction value of M1, M3, and M5 turns into correction value corresponding to the correction value which amended M2 and M4 by drawing 15 (e). M1, M3, and M5 -- this correction value -- a control unit 50 -- a shift device -- controlling (a shift device being controlled in the direction of -Y in this case) -- M1, M3, and M5 are amended in the direction of an arrow head in M1 and M5. [therefore,] At this time, M2 and M4 are in the scan termination location of a sensitization substrate, it is deforming in the direction of -Y more greatly in this location to the ideal sensitization substrate (refer to broken-line section) in which deformation does not have a sensitization substrate (refer to continuous-line section), and the correction value corresponding to this direction of -Y is registered into storage 51. And when a control unit 50 controls a shift device in the direction of -Y based on this correction value, M2 and M4 are amended in the direction of an arrow head of drawing.
[0088] Finally, in drawing 15 (g), the case where M1, M3, and M5 drive even in the location of M2 and M4 of drawing 15 (f) is shown, and the correction value of M1, M3, and M5 turns into correction value corresponding to the correction value which amended M2 and M4 by drawing 15 (e). M1, M3, and M5 -- this correction value -- a control unit 50 -- a shift device -- controlling (a shift device being controlled in the direction of -Y in this case) -- M1, M3, and M5 are amended in the direction of an arrow head in M1 and M5. [therefore,] At this time, M2 and M4 carry out exposure termination, and control of a shift device and a scale-factor amendment device is not performed.

[0089] As mentioned above, the nonlinear component of the exposure error of a scanning direction is beforehand registered as correction value, and the image shift device and scale-factor device of a scanning direction of projection optics M1-M5 are continuously controlled based on this correction value. Although drawing 14 and drawing 15 explained amendment of the projection optics M1-M5 in a typical location, there is more correction value registered according to the exposure location in fact, and the shift amount and scale factor in each location differ from each other, respectively. Moreover, projection optics M1-M5 has the image formation property adjustment device 120 which becomes the interior from the shifter section 41 (shift device), the scale-factor controller 45 (scale-factor amendment device), and the rotation amendment section 43 (rotation amendment device), respectively, and is continuously controlled by the control unit 50 respectively separately.
[0090] By the way, also in the former, moving an imprint image in the direction of X and the direction of Y, or establishing the image shift, the rotation, and the scale-factor adjustment device which consists of a device moved to a hand of cut to an optical axis and a device in which the scale factor of an imprint image is adjusted, embracing a perpendicularity error, and making each projection optics shift and rotate an imprint image was performed (refer to JP,8-8172,A). However, the shift and rotation by the above-mentioned adjustment device were linearity amendment to the last, and were what the above-mentioned adjustment device is used [what], and shifts or rotates the projection optics of the 1st projection train, and the projection optics of the 2nd projection train.
[0091] On the other hand, in the scanning aligner concerning the gestalt of this operation, change of the configuration of the sensitization substrate containing a nonlinear component is beforehand registered as correction value, and pattern exposure is performed, controlling continuously the image formation property adjustment device 120 of the scanning direction of each projection optics based on the registered correction value, respectively. For example, as shown in drawing 15 (d), while not amending about M2 and M4 and reducing a scale factor about M1 and M3, it amends so that it may shift in the direction of a core, and about M3, it amends so that only contraction of a scale factor may be performed. And such adjustment is continuously controlled by the control unit 50. Thereby, the error by the nonlinear component which was not able to be amended can also be amended in linearity amendment of the projection optics of the 1st and 2nd projection train.
[0092] Drawing 16 is a flow chart which shows the sequence of scan exposure, and it performs pattern exposure, controlling continuously the image formation property adjustment device 120 of projection optics 12a-12e based on the correction value registered beforehand. As mentioned above, in order that the liquid crystal panel of an active-matrix method may form the active component, it is necessary to pile up and expose two or more patterned layers by the production process. For this reason, two or more masks 10 used as a negative are prepared, and superposition exposure of a patterned layer is performed, exchanging masks.
[0093] First, when the judgment of step S20 is "YES" when exchanged by the mask loader which the mask 10 currently laid in the mask stage 20 does not illustrate namely, it progresses to step S21 and the new mask 10 is positioned to an aligner by the alignment systems 20a and 20b held by the attachment component holding projection optics 12a-12e. As drawing 9 explained, this positioning detects the mask marks 23a and 23j by the alignment systems 20a and 20b, and it is performed by adjusting by the driving means which does not illustrate the location of the mask laid on the mask stage 20 so that the location of the mask mark to the index mark 28 may serve as predetermined relation. When masks are not exchanged, this step S21 is skipped.
[0094] Subsequently, loading of the sensitization substrate 14 which should be exposed on the substrate stage 15 with the substrate loader which progresses to step S22 and is not illustrated is carried out, and the loaded sensitization substrate 14 is positioned to an aligner. The alignment systems 20a and 20b detect the substrate marks 24a and 24j as well as the alignment of the mask 10 in step S21, and specifically, it is carried out by controlling the driving means which was established on the substrate stage 15 and which is not illustrated so that the location of the substrate marks 24a and 24j to the index mark 28 may serve as predetermined relation.
[0095] At step S23, the outward trip scan of a mask 10 and the sensitization substrate 14 is synchronously carried out to projection optics 12a-12e by driving a mask stage 20 and the substrate stage 15 for example, in the direction of -X by direction driving gear of X 18X of a mask stage 20, and direction driving gear of X 16X of the substrate stage 15. One alignment system 20a detects the

relative position of the mask marks 23a-23e and the substrate marks 24a-24e in that case. Alignment system 20b of another side detects the relative position of the mask marks 23f-23j and the substrate marks 24f-24j. In this way, the relative position with the detected mask marks 23a-23e, 23f-23j and the substrate marks 24a-24e, and 24f-24j is memorized by storage 51.

[0096] Termination of the outward trip scan of a mask 10 and the sensitization substrate 14 performs alignment of a mask 10 and the sensitization substrate 14 in the scan starting position from which the mask 10 separated completely from the lighting fields 11a-11e, and the sensitization substrate 14 separated completely from the projection fields 13a-13e. This alignment of step S24 The substrate marks 24a-24e which make the mask marks 23a-23e, 23f-23j and it which are detected between outward trip scans in step S23, and are memorized by storage 51, and a pair, the direction of X of the mask 10 with which the relative-position error of 24f-24j serves as min, The movement magnitude of the direction of Y and a hand of cut is calculated with a least square method etc., and it is carried out by adjusting by the driving means which does not illustrate the location of the mask 10 on a mask stage 20 according to it.

[0097] Then, scan exposure is performed by progressing to step S25 and carrying out the synchronous scan (return trip scan) of a mask 10 and the sensitization substrate 14 in the direction of +X to projection optics 12a-12e.

[0098] A control unit 50 controls continuously the image formation property adjustment device 120 of each projection optics 12a-12e based on the correction value registered beforehand, respectively during this scan exposure. That is, the correction value about the sensitization substrate which corresponds beforehand is stored in storage 51 by the exposure processing and correction value registration by the flow of drawing 12 , and a control unit 50 reads the correction value about the sensitization substrate which corresponds from storage 51, and controls the shift device and scale-factor amendment device of the non-scanning direction of each projection optics 12a-12e. Based on the read correction value, in a detail, a control unit 50 computes the target position of the shift device of the non-scanning direction, and a scale-factor amendment device, and drives these adjustment device during scanning exposure in it. Moreover, in drawing 14 and drawing 15 , the shift device and scale-factor amendment device of the non-scanning direction of M1, M3, and M5 are driven in the location connected with amendment of M2 and M4. Thus, the correction value of M1, M3, and M5 is always driven to M2 and M4 for the purpose of the correction value of the coordinate which was overdue by lens spacing.

[0099] By carrying out like this, the optimal nonlinear amendment becomes realizable in the equipment configuration which has the image formation optical system 12a-12e from which lens spacing differs. Consequently, the projection field by projection optics 12b and 12d and the projection field by projection optics 12a, 12c, and 12e are very accurate, and can expose one big pattern which overlapped and continued mutually in the long and slender field without unevenness of exposure.

[0100] Although the example which performs nonlinear amendment of the non-scanning direction was explained as mentioned above, the example which realizes nonlinear amendment of the scanning direction further is stated by the same approach. Drawing 17 is drawing showing the modification of the sensitization substrate 14. Among drawing, the rectangle part shown in a broken line expresses an ideal sensitization substrate without deformation, and this drawing continuous-line part expresses the sensitization substrate which both the scanning direction and the non-scanning direction deformed in the shape of a curve by passing through various processes. Besides the example of drawing 17 , there are various modifications, such as a slack type, a spool mold, and a shuttle-race-back mold. An exposure gap is amended about the sensitization substrate which has produced such deformation.

[0101] Drawing 18 is the plan of the sensitization substrate 14 held on the substrate stage 15. The alignment marks (substrate mark) 24k-24p are further added to the sensitization substrate 14 in the non-scanning direction of the outside of exposure field 14a. That is, in order to compute the nonlinear component of the scanning direction in addition to nonlinear amendment of the non-scanning direction, as shown in drawing 18 , the substrate marks (mark for heavy measurement) 24k-24p which measure two or more superposition precision are arranged, and a measure point is added. The configuration of forming the vernier which replaces with the above-mentioned substrate marks

24a-24p, and measures two or more superposition precision here on the sensitization substrate 14 may be used.
[0102] Drawing 19 and drawing 20 are drawings showing the sequence of amendment of a nonlinear component, and are the same as that of the gestalt (refer to drawing 14 and drawing 15) of the 1st operation except controlling the shift device of the scanning direction. In these drawings, M1-M5 express the projection field of five projection optics 12a-12e. Moreover, the sensitization substrate 14 expresses the sensitization substrate (refer to continuous-line section) which both the scanning direction and the non-scanning direction deformed in the shape of a curve like said drawing 17 to the ideal sensitization substrate (refer to broken-line section) without deformation.
[0103] Drawing 19 (a) is the phase of exposure initiation, and the exposure of M2 and M4 which is the 1st projection train among five projection fields M1-M5 starts. According to the correction value (correction factor) registered into storage 51, the shift device of the non-scanning direction of M2 and M4 and the scanning direction and a scale-factor amendment device are controlled in this phase. Specifically, projection optics [12b and 12d] the shifter sections 41 and 42 (shift device) and the scale-factor controller 45 (scale-factor amendment device) of the image formation property adjustment device 120 of the 1st projection train are controlled by the control unit 50.
[0104] In drawing 19 (b), exposure of M1, M3, and M5 which are the 2nd projection train starts. In this phase, M2 and M4 are exposing the location of M1, M3 and M5, and the lens spacing part point of M2 and M4. Also in M1, M3, and M5, a control unit 50 controls the shifter sections 41 and 42 (shift device) and the scale-factor controller 45 (scale-factor amendment device) like amendment of M2 and M4. Here, the shift device and scale-factor amendment device of the non-scanning direction of M1, M3, and M5 and the scanning direction are driven to the target position in the location of drawing 19 (b), i.e., the location connected with amendment of M2 and M4 of drawing 19 (a). Thus, the correction value of M1, M3, and M5 is always driven to M2 and M4 for the purpose of the correction value of the coordinate which was overdue by lens spacing. By carrying out like this, the optimal nonlinear amendment becomes realizable in the equipment configuration which has the image formation optical system from which lens spacing differs.
[0105] Moreover, M2 and an about [M4] arrow head show that the correction value for performing control which reduces a scale factor in the location is registered, and the arrow head of the M2 and M4 interior shows that the correction value for performing shift control in the direction of an arrow head in the location is registered. In addition, the die length of an arrow head expresses the magnitude of the amount of amendments of correction value typically.
[0106] At this time, both the scanning direction and the non-scanning direction are deforming M2 and M4 in the shape of a curve in this location to the ideal sensitization substrate (refer to broken-line section) in which deformation does not have a sensitization substrate (refer to continuous-line section). While making M2 and M4 reduce to storage 51, the correction value which carries out shift amendment is registered in the direction of an arrow head (the direction of X, and the direction of Y). a control unit 50 -- this correction value -- following -- a shift device and a scale-factor amendment device -- controlling (it controlling to reduce a scale factor in this case, and to shift to the direction of a core and scanning direction (the direction of X) of a sensitization substrate) -- M2 and M4 are amended in the direction of an arrow head in M2 and M4.
[0107] In drawing 19 (c), the case where M1, M3, and M5 drive even in the location of M2 and M4 of drawing 19 (b) is shown, and the correction value of M1, M3, and M5 turns into correction value corresponding to the correction value which amended M2 and M4 by drawing 19 (b). M1, M3, and M5 -- this correction value -- a control unit 50 -- a shift device and a scale-factor amendment device -- controlling (it controlling to reduce a scale factor in this case, and to shift to the direction of a core and scanning direction of a sensitization substrate) -- M1 and M5 are amended in the direction of an arrow head in M1 and M5 among M1, M3, and M5. [therefore,]
[0108] At this time, M2 and M4 which are preceded with M1, M3, and M5 are approaching the center position of a sensitization substrate, and they have arrived at the deformation location still fewer than deformation of drawing 19 (b). In this location, correction value with a scale factor and a shift amount smaller than the correction value of drawing 19 (b) is registered. and the control unit 50 -- a shift device and a scale-factor amendment device -- controlling (it controlling to reduce a scale factor in this case, and to shift to the direction of a core, and a scanning direction) -- M2 and M4 are

amended in the direction of an arrow head in M2 and M4.
[0109] In drawing 20 (d), the case where M1, M3, and M5 drive even in the location of M2 and M4 of drawing 19 (c) is shown, and the correction value of M1, M3, and M5 turns into correction value corresponding to the correction value which amended M2 and M4 by drawing 19 (c). Therefore, as for M1, M3, and M5, a control unit 50 controls a shift device and a scale-factor amendment device by this correction value, and M1 and M5 are amended in the direction of an arrow head in M1 and M5 among M1, M3, and M5. At this time, M2 and M4 do not have deformation of a sensitization substrate in this location, and correction value is 0. Therefore, amendment of M2 and M4 is not performed.
[0110] In drawing 20 (e), since the case where M1, M3, and M5 drive even to the center position of the sensitization substrate which is the location of M2 and M4 of drawing 20 (d) is shown and there is no deformation of a sensitization substrate, amendment of M1, M3, and M5 is not performed. At this time, M2 and M4 are approaching the scan termination location of a sensitization substrate, in this location, the sensitization substrate (refer to continuous-line section) is deforming in the direction of -Y, and the direction of -X slightly to an ideal sensitization substrate (refer to broken-line section) without deformation, and the correction value which shifts M2 and M4 in this direction of -Y is registered into storage 51. And when a control unit 50 controls a shift device in the direction of -Y, and the direction of -X based on this correction value, M2 and M4 are amended in the direction of an arrow head of drawing.
[0111] In drawing 20 (f), the case where M1, M3, and M5 drive even in the location of M2 and M4 of drawing 20 (e) is shown, and the correction value of M1, M3, and M5 turns into correction value corresponding to the correction value which amended M2 and M4 by drawing 20 (e). M1, M3, and M5 -- this correction value -- a control unit 50 -- a shift device -- controlling (a shift device being controlled in the direction of -Y, and the direction of -X in this case) -- M1 and M5 are amended in the direction of an arrow head in M1 and M5 among M1, M3, and M5. [therefore,] M2 and M4 are in the scan termination location of a sensitization substrate, and both the scanning direction and the non-scanning direction are deforming them in the shape of a curve in this location to the ideal sensitization substrate (refer to broken-line section) in which deformation does not have a sensitization substrate (refer to continuous-line section) at this time. The correction value corresponding to this scanning direction and the non-scanning direction is registered into storage 51. And when a control unit 50 controls a shift device in the scanning direction and the non-scanning direction based on this correction value, M2 and M4 are amended in the direction of an arrow head of drawing.
[0112] Finally, in drawing 20 (g), the case where M1, M3, and M5 drive even in the location of M2 and M4 of drawing 20 (f) is shown, and the correction value of M1, M3, and M5 turns into correction value corresponding to the correction value which amended M2 and M4 by drawing 20 (e). M1, M3, and M5 -- this correction value -- a control unit 50 -- a shift device -- controlling (a shift device being controlled in the direction of -Y, and the direction of -X in this case) -- M1, M3, and M5 are amended in the direction of an arrow head in M1 and M5. [therefore,] At this time, M2 and M4 carry out exposure termination, and control of a shift device and a scale-factor amendment device is not performed.
[0113] As mentioned above, the nonlinear component of the exposure error of a scanning direction and a non-scanning direction is beforehand registered as correction value, and the image shift device and scale-factor device of a scanning direction of projection optics 12a-12e are continuously controlled based on this correction value. Although drawing 19 and drawing 20 explained amendment of the projection optics 12a-12e in a typical location, there is more correction value registered according to the exposure location in fact, and the shift amount and scale factor in each location differ from each other, respectively. Moreover, projection optics 12a-12e has the image formation property adjustment device 120 which becomes the interior from the shifter sections 41 and 42 (shift device), the scale-factor controller 45 (scale-factor amendment device), and the rotation amendment section 43 (rotation amendment device), respectively, and is continuously controlled by the control unit 50 respectively separately.
[0114] Next, the example in the case of using a rotation amendment device is explained. When a control unit 50 controls the shift device of the non-scanning direction of projection optics, the shift

device of the scanning direction, a scale-factor amendment device, and a rotation amendment device, the nonlinear shift component of the non-scanning direction and the scanning direction and a scale-factor component are amended, and nonlinear amendment of the scanning direction is made to inherit smoothly, in case nonlinear amendment of the non-scanning direction and the scanning direction is realized.
[0115] For example, in the sensitization substrate which both the scanning direction and the non-scanning direction deformed in the shape of a curve as shown in said drawing 17 , the sequence of amendment of the nonlinear component explained by said drawing 19 and drawing 20 is performed. Drawing 21 is the conceptual diagram showing the example which amends a nonlinear component using a rotation amendment device. It is shown that the about [projection field M1-M5] arrow head of projection optics 12a-12e performs amendment which reduces a scale factor in the location, it is shown that the arrow head of the M1 - M5 interior performs shift amendment in the direction of an arrow head in the location, and it is shown that a circular arrow head performs rotation amendment in the direction.
[0116] The correction value about the sensitization substrate which corresponds beforehand is stored in storage 51 by the exposure processing and correction value registration by the flow of drawing 12 , and based on the read correction value, a control unit 50 computes the target position of the shift device of the non-scanning direction and the scanning direction, a scale-factor amendment device, and a rotation amendment device, and drives these adjustment device during scanning exposure. Especially, with the gestalt of this operation, by using the rotation amendment section 43 (rotation amendment device) of the image formation property adjustment device 120, as shown in drawing 21 , both the scanning direction and the non-scanning direction are carrying out rotation amendment of the projection fields M1, M2, M4, and M5 to compensate for deformation of the sensitization substrate which deformed in the shape of a curve. Consequently, the projection fields M2 and M4 and the projection fields M1, M3, and M5 will be joined together smoothly, and can expose one continuous big pattern that there is much more no unevenness of exposure.
[0117] In addition, like drawing 2 and 3, when it passes along a field diaphragm 34 after the rotation amendment section, the location of a projection field does not change but only the pattern projected on the field comes to rotate it. Therefore, when amending like drawing 21 , it is good for a rectangular prism 35 to prepare the rotation amendment section.
[0118] The scanning aligner explained so far asks for a nonlinear component with error by the exposure result beforehand. It is what performs pattern exposure while registering with storage 51 as correction value on equipment and controlling continuously the image adjustment device of the scanning direction of projection optics, and the non-scanning direction based on correction value. In order to register correction value into storage 51, the mask 10 and the sensitization substrate 14 needed to be used, and the error needed to be measured (however, this error measurement). It is [that what is necessary is to perform beforehand and to store data only when registration data are required] unnecessary when necessary data are registered.
[0119] Here, many measure points for amending a nonlinear component are installed in a sensitization substrate, and if these measure points are detected at the time of alignment and correction value is calculated, the scanning aligner which does not perform trial exposure is realizable. For example, a large number are arranged as an alignment mark instead of the measure point shown in drawing 6 and drawing 18 , and both a linearity component and a nonlinear component are computed by alignment location detection. Moreover, nonlinear amendment of the non-scanning direction can also use a vernier or the mark for heavy measurement about nonlinear amendment of the scanning direction using an alignment mark. In addition, also when much alignment marks are arranged and a random nonlinear component is in a sensitization substrate in a thing, it can amend appropriately. Moreover, the approach of carrying out the image processing of direct reading and the read result for the exposure pattern (real pattern) produced on the sensitization substrate 14 instead of the above-mentioned mark, and calculating the deformation of the sensitization substrate 14 may be used.
[0120] In the aforementioned example, since the alignment point size under exposure increases, that a throughput declines poses a problem. Then, the aforementioned example is not carried out with all sensitization substrates, but is carried out with two or more sensitization substrates of the lot

beginning or the beginning, and you may make it amend it about the remaining sensitization substrate based on the operation result. If it does in this way, an error can be made into the minimum, without reducing a throughput.
[0121] In addition, with the gestalt of each above-mentioned implementation, although it is the example of application used as the aligner with two or more image formation optical system, the approach of not using trial exposure, and the approach of enforcing with two or more sensitization substrates of the lot beginning or the beginning are applicable also except an aligner with two or more image formation optical system. Moreover, it may be made to perform by choosing according to the pattern (class) of a mask in the time of the pattern which seldom needs precision, and a pattern with a severe precision.
[0122] In addition, although the rotation amendment section and a scale-factor controller are prepared [both] in the Dyson mold optical system of an upper case in the above-mentioned example, it may prepare in the Dyson mold optical system of the lower berth, or it may divide into the Dyson mold optical system of an upper case and the lower berth, and you may prepare. Moreover, although shifters 41 and 42 are provided so that it may arrange between a mask 10 and the projection lens 32, you may make it prepare between a substrate 14 and the projection lens 36. Moreover, in an aligner, when scanning the stage in which the substrate was laid to projection optics, an error is in the run precision of the stage, and when not scanning linearly, it becomes possible to expose a pattern with a sufficient precision on a substrate by amending the location of a projection image optically using the image formation property adjustment device of this invention installed in projection optics.
[0123] Moreover, although it explained that the pattern of a mask is projected on a stage, an image sensor detected the image and it was set relatively when acting as the monitor of the rotation of a rectangular prism 31, you may make it measure the amount toward which the rectangular prism 31 actually inclined by irradiating a light beam to the field of a rectangular prism 31, and measuring the location of the return light. If the image formation property adjustment device of this invention prepared in projection optics is used also about the drawing error of a mask pattern, it is possible to amend, in case it projects on a substrate.
[0124]
[Effect of the Invention] Since according to this invention it has the image formation property adjustment device in which the location of the projection image projected on a substrate is adjusted to projection optics and the shift of a projection image, rotation, a focal location, and a scale factor become controllable according to an image formation property adjustment device, also when the adjustment at the time of the assembly of two or more projection optics becomes easy and the need for readjustment arises during equipment employment, it becomes possible to shorten an equipment stop time. Moreover, in scan exposure, the residual component of the error of linearity amendment can be stopped to the minimum, and highly minute-ization can be realized to the inside to which enlargement of a sensitization substrate and a device goes.

[Translation done.]

DESCRIPTION OF DRAWINGS

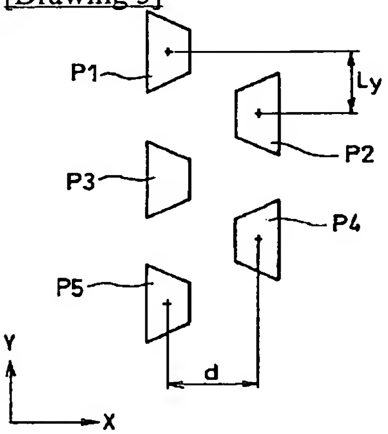
[Brief Description of the Drawings]
[Drawing 1] Drawing showing the rough configuration of an example of the scanning aligner by this invention.
[Drawing 2] Drawing showing the amendment device of the lens module with which projection optics was equipped.
[Drawing 3] The detail perspective view of projection optics.
[Drawing 4] The detail side elevation of projection optics.
[Drawing 5] Line schematic drawing showing the location of an imprint image.
[Drawing 6] The plan of the sensitization substrate held on the substrate stage.
[Drawing 7] The plan of a mask.
[Drawing 8] Drawing of the mask mark picturized by the alignment system.
[Drawing 9] Drawing of the mask mark picturized by the alignment system and a substrate mark.
[Drawing 10] Drawing showing the modification of a sensitization substrate.
[Drawing 11] Drawing showing the example of arrangement for a substrate mark.
[Drawing 12] The flow chart which shows the processing which registers the nonlinear component of the exposure error of a scanning direction.
[Drawing 13] Drawing which explains an operation for the amount of amendments.
[Drawing 14] Drawing showing the sequence of amendment of a nonlinear component (the 1).
[Drawing 15] Drawing showing the sequence of amendment of a nonlinear component (the 2).
[Drawing 16] The flow chart which shows the sequence of scan exposure.
[Drawing 17] Drawing showing the modification of a sensitization substrate.
[Drawing 18] Drawing showing the example of arrangement for a substrate mark.
[Drawing 19] Drawing showing the sequence of amendment of a nonlinear component (the 1).
[Drawing 20] Drawing showing the sequence of amendment of a nonlinear component (the 2).
[Drawing 21] Drawing showing amendment of a nonlinear component.
[Drawing 22] The perspective view showing the configuration of the outline of the conventional scanning aligner.
[Drawing 23] Drawing showing the important section of drawing 20 .
[Drawing 24] Drawing showing the exposure image of the scan by the conventional scanning aligner, and a step.
[Drawing 25] Drawing explaining alignment (alignment) actuation with the mask and sensitization substrate which are performed with the conventional scanning aligner.
[Drawing 26] Drawing explaining deformation of the plate produced in a process.
[Description of Notations]
L1-L5 [-- Pattern space,] -- An illumination-light study system, 9 -- A field diaphragm, 10 -- A mask, 10a 11a-11e -- A lighting field, 12a-12e -- Projection optics (image formation optical system), 13a-13e -- A projection field, 14 -- A sensitization substrate, 14a, 14b -- Pattern exposure field, 15 -- A substrate stage, the direction driving gear of 16 Y--Y, 17X, 17Y -- Location measuring device, The direction driving gear of 18 Y--Y, 19X, 19Y -- A location measuring device, 20a, 20b -- Alignment system, 22a, 22b -- A substrate mark, 23a-23j -- A mask mark, 24a-24j -- Substrate mark, 24k-24p -- An alignment mark, 27 -- An observation visual field, 28 -- Index mark, 31 [-- Field diaphragm,] -- A rectangular prism, 32 -- A lens, 33 -- A concave mirror, 34 35 [-- Parallel

monotonous glass,] -- A rectangular prism, 36 -- A lens, 37 -- 41 A concave mirror, 42 43 [-- An actuator, 47 / -- Amendment optical system, 50 / -- A control unit, 51 / -- Storage, 55 / -- An image sensor, M1-M5 / -- Projection field] -- A prism base, 44a, 44b -- A piezo-electric element, 45 -- Zoom optical system, 46

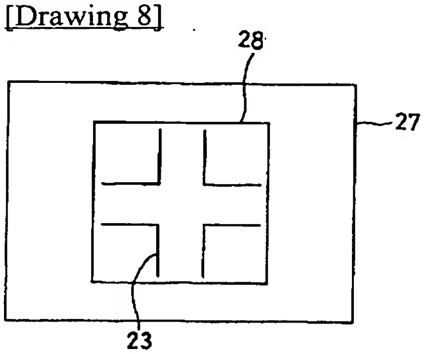
[Translation done.]

DRAWINGS

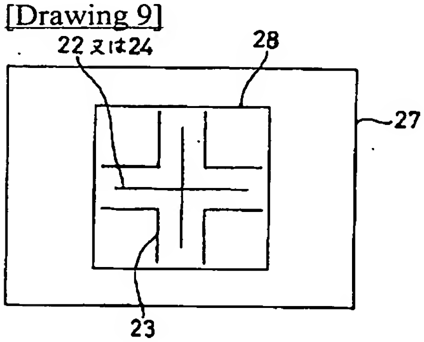
[Drawing 5]



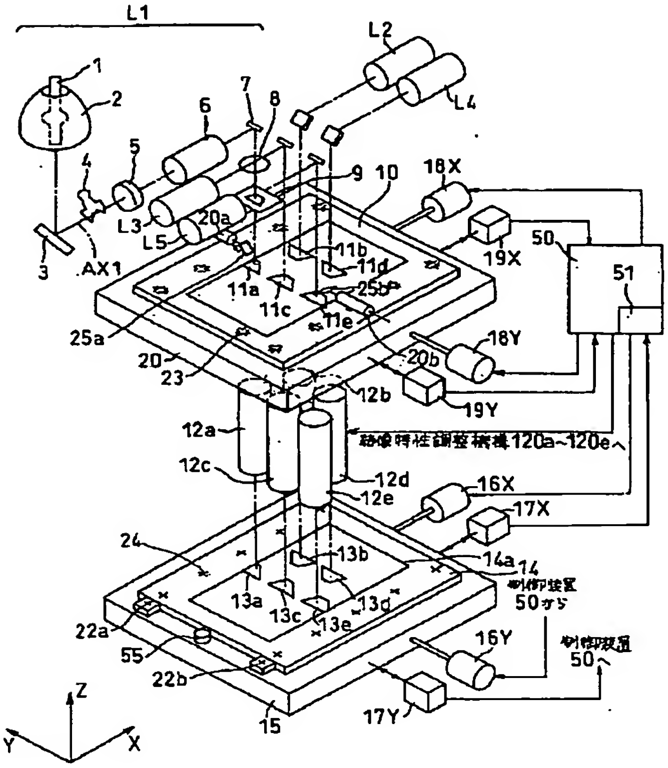
[Drawing 8]



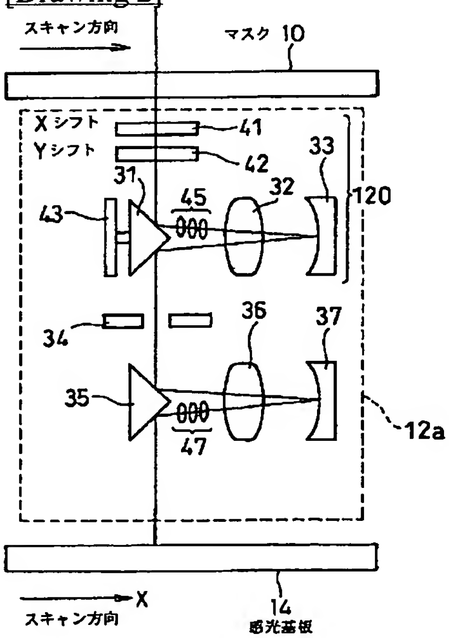
[Drawing 9]



[Drawing 1]

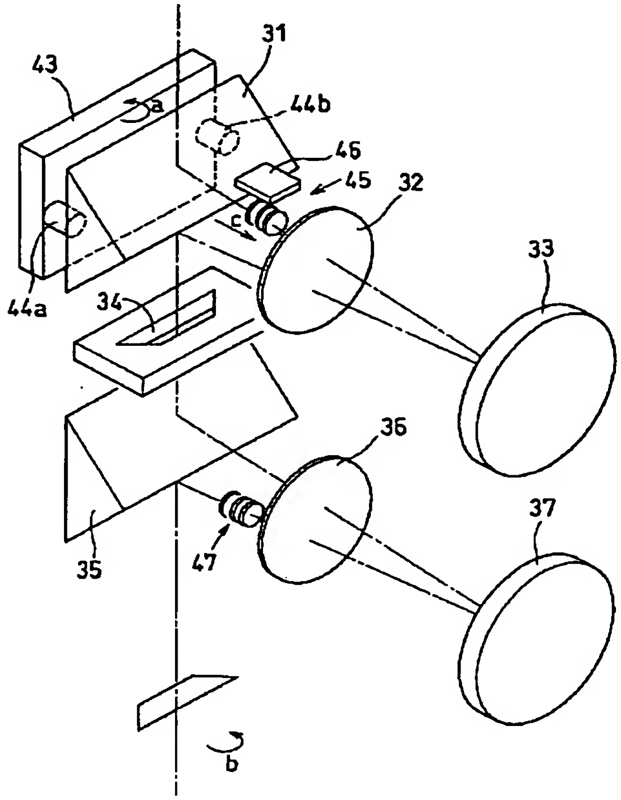


[Drawing 2]

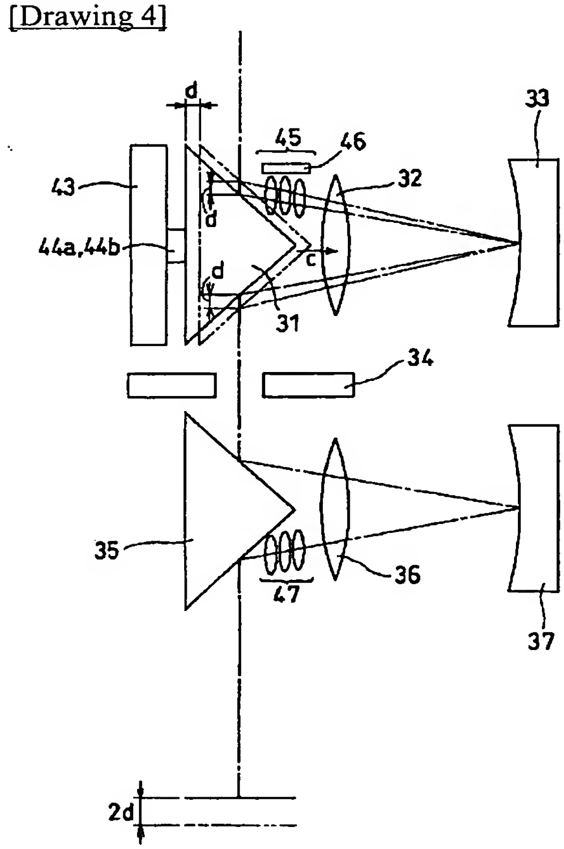


レンズモジュールの補正機構

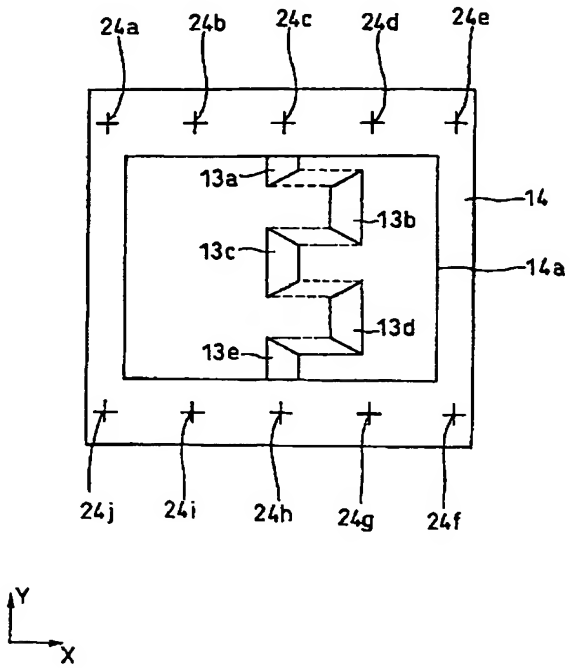
[Drawing 3]



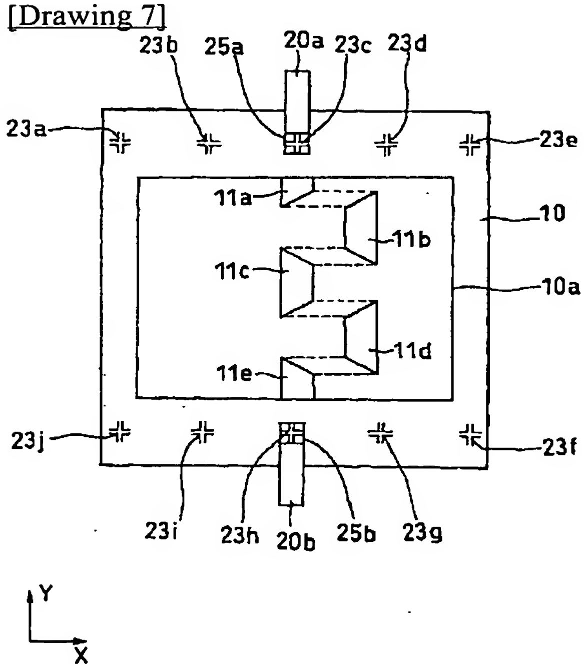
[Drawing 4]



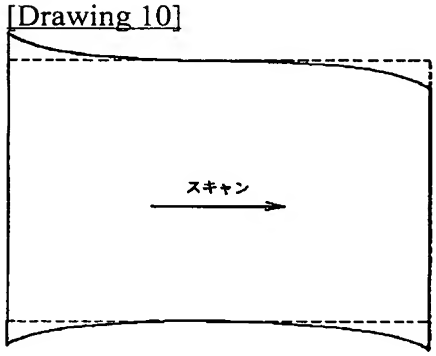
[Drawing 6]



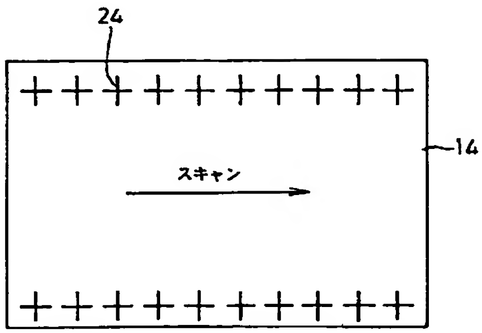
[Drawing 7]



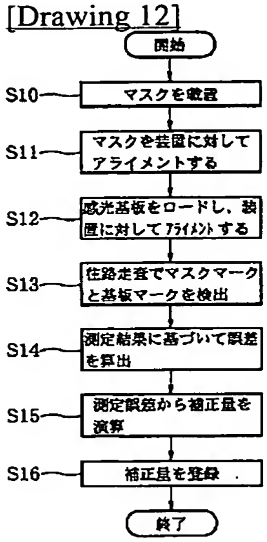
[Drawing 10]



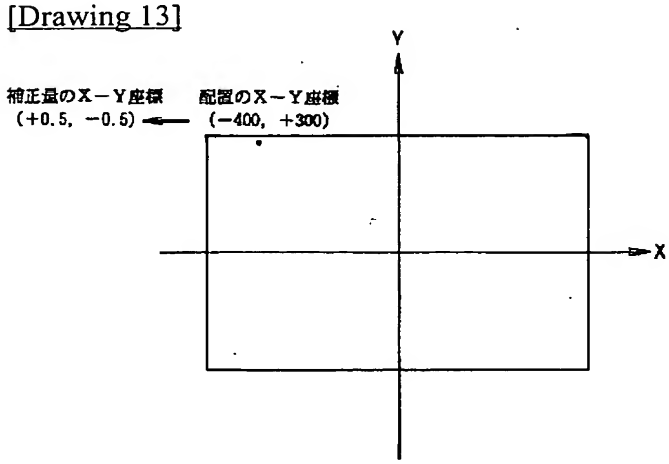
[Drawing 11]



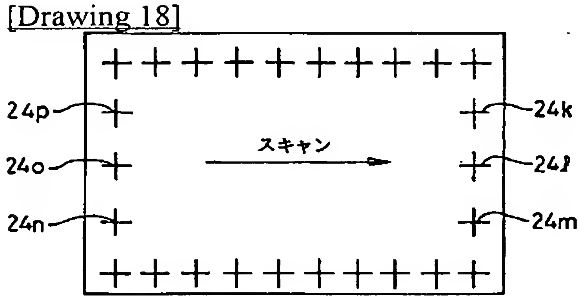
[Drawing 12]



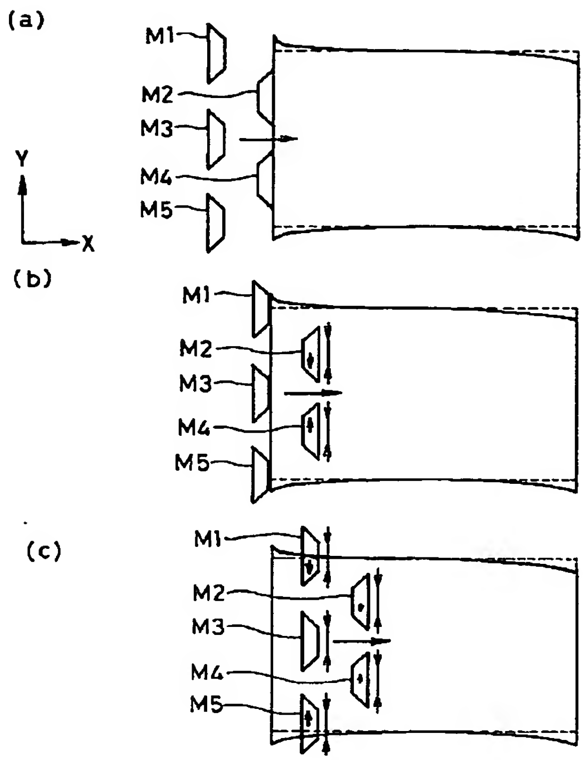
[Drawing 13]



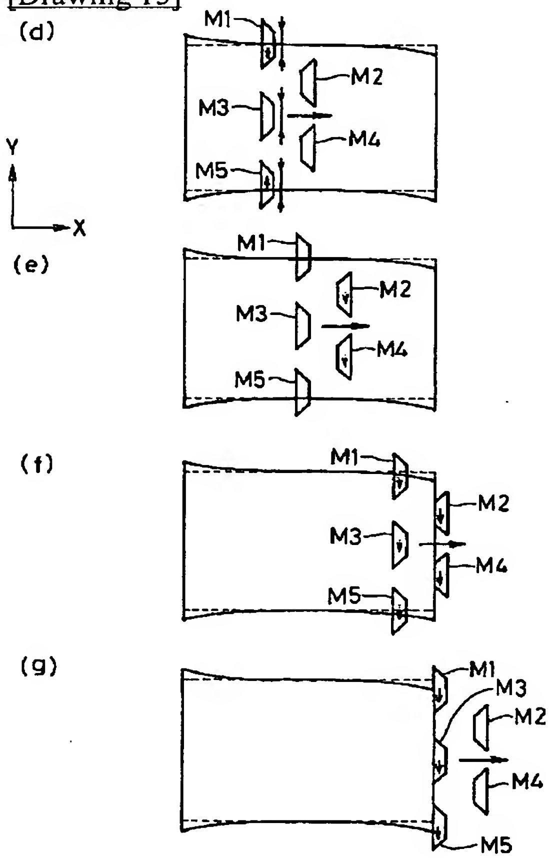
[Drawing 18]



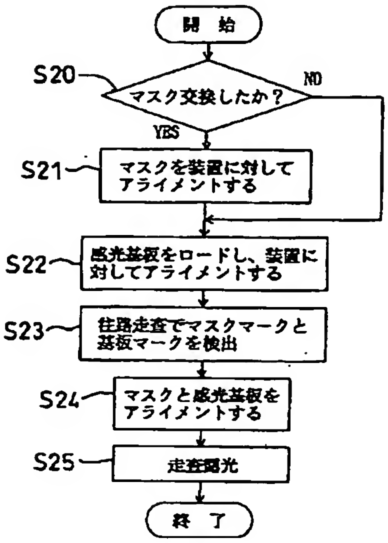
[Drawing 14]



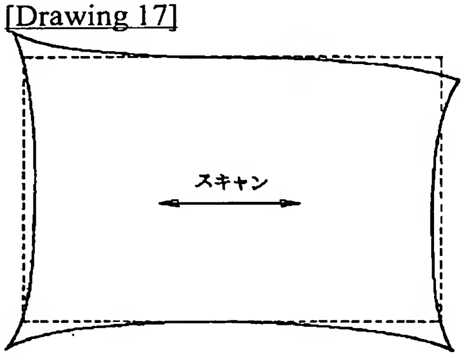
[Drawing 15]



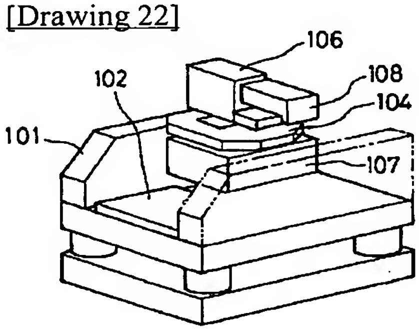
[Drawing 16]



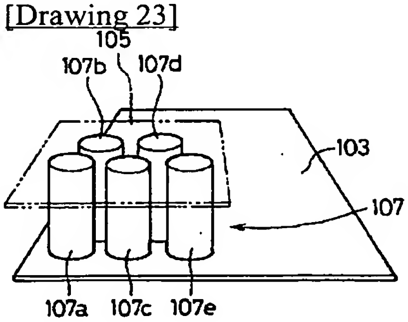
[Drawing 17]



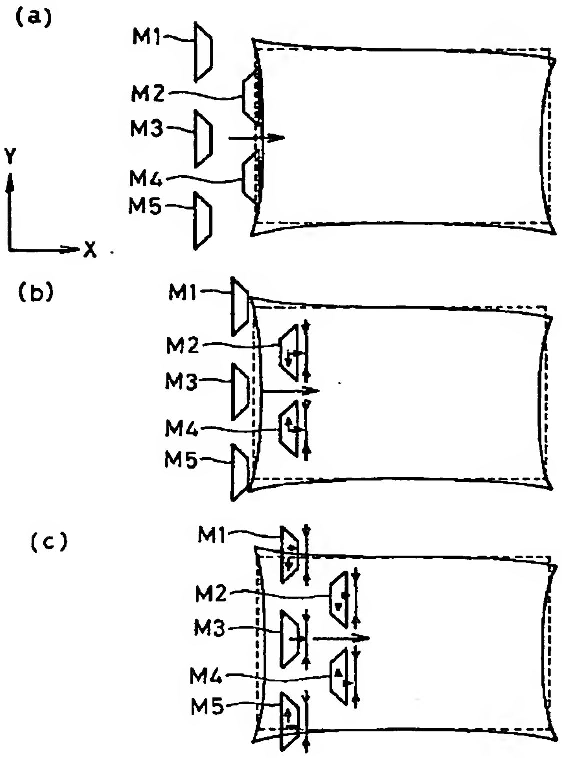
[Drawing 22]



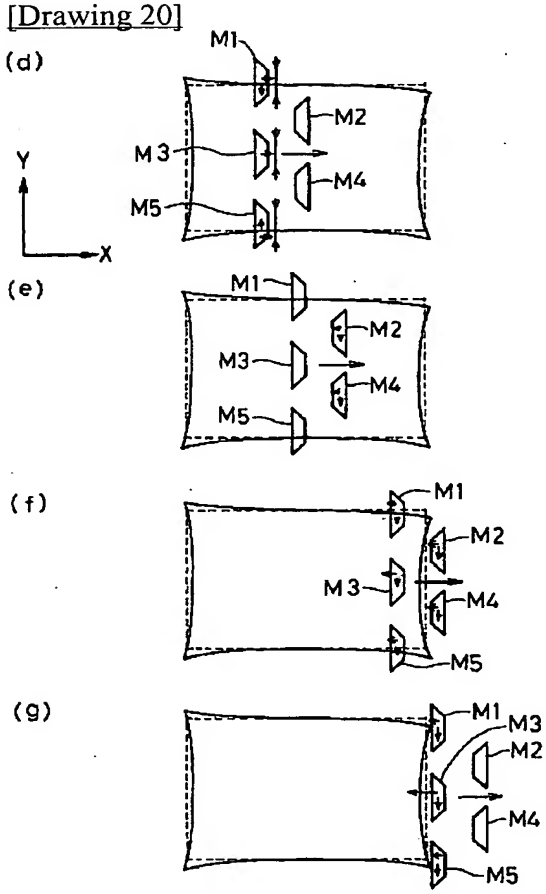
[Drawing 23]



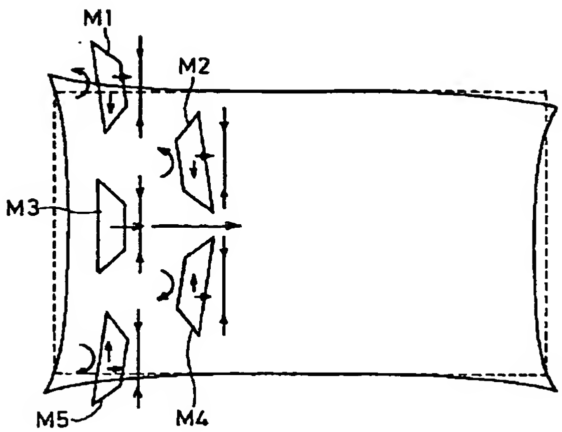
[Drawing 19]



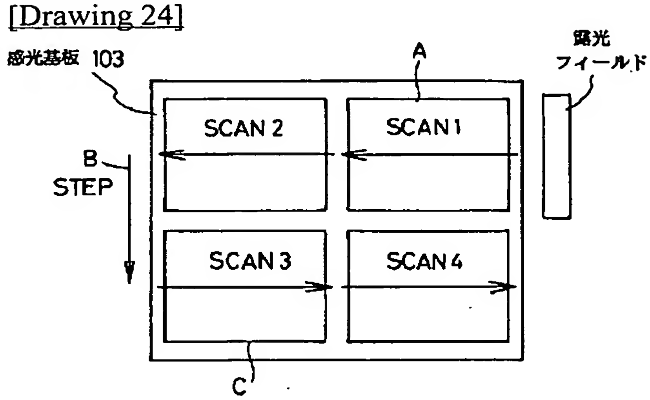
[Drawing 20]



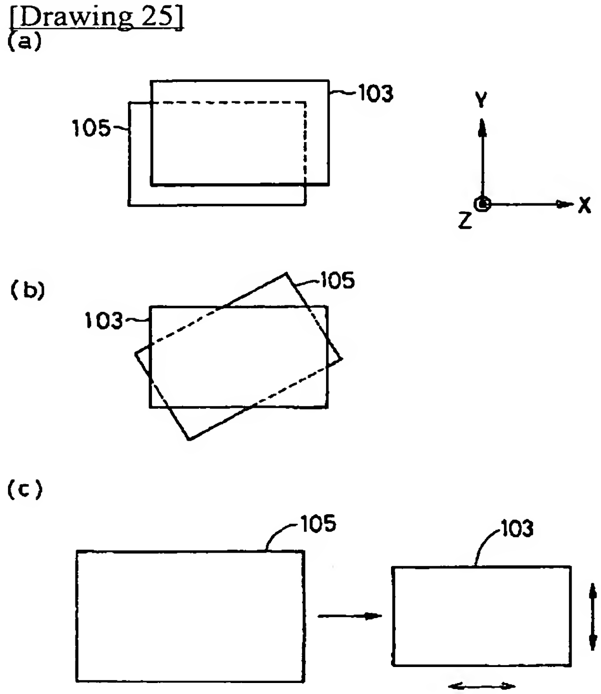
[Drawing 21]



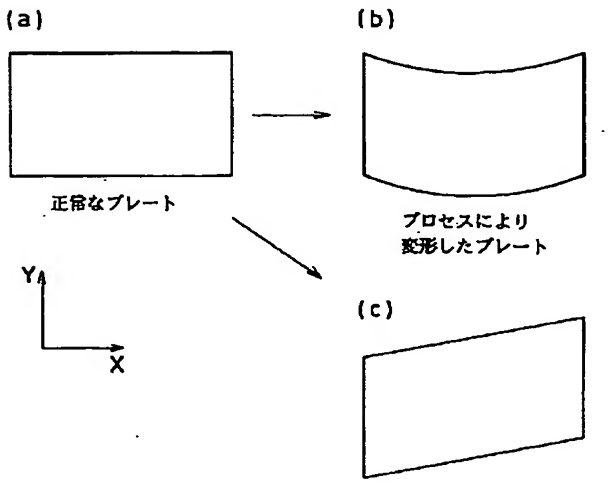
[Drawing 24]



[Drawing 25]



[Drawing 26]



[Translation done.]